Measuring the Food Security of Elderly Persons

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This study assessed the appropriateness of the U.S. Food Security Scale for measuring the food security of elderly persons and, in particular, whether measured prevalence rates of food insecurity and hunger among the elderly were likely to be biased, relative to those of the nonelderly. The findings, based on analysis of 3 years of data from the Current Population Survey Food Security Supplement, consistently indicated that the Food Security Scale fairly represented the food security status of elderly persons, compared with the food security status of nonelderly persons. Statistical analysis of the multiple-indicator scale found no indication that the scale underrepresented the prevalence of food insecurity or hunger among the elderly because they interpreted or responded to questions in the Food Security Scale differently than did the nonelderly. Responses to questions other than those in the scale indicated that some elderly did face food-access problems other than insufficient resources to buy food—most notably problems getting to a food store. However, these problems were no more likely for the elderly than for the nonelderly to be so serious that desired eating patterns were disrupted or food intake was insufficient. A small proportion of elderly households classified as food-secure obtained food assistance from Federal and community programs, suggesting that some of these households were less than fully food-secure and that some may, indeed, be food-insecure. However, food-secure elderly-only households were less likely than the food-secure nonelderly households to rely on food assistance programs that are accessible to both.

Elderly persons are more food-secure than are nonelderly persons, according to recent nationally representative food security surveys sponsored by the U.S. Department of Agriculture (USDA) (Nord, 2002; Nord et al., 2002; Guthrie & Lin, 2002; Andrews, Nord, Bickel, & Carlson, 2000; Bickel, Carlson, & Nord, 1999). In these surveys, food security—defined as access at all times to enough food for an active, healthy life for all household members—is measured by a series of questions about behaviors and experiences known to characterize households that are having difficulty meeting their food needs (Fitchen, 1981; Fitchen, 1988; Radimer, Olson, & Campbell, 1990; Radimer, Olson, Green, Campbell & Habicht, 1992; Wehler, Scott, & Anderson, 1992). The U.S. Food Security Scale, calculated from responses to these questions, measures the food security of the household and classifies each as food-secure, food-insecure without hunger, or food-insecure with hunger (Bickel, Nord, Price, Hamilton, & Cook, 2000; Hamilton et al., 1997a; 1997b). Concerns have been raised about whether this measurement method, based on self-reported food-access conditions and behaviors, fairly represents the food security of elderly persons, compared with that of non-elderly persons. Food insecurity is known to be associated with poor nutrition and health

outcomes for elderly people, and age aggravates the negative effects of poor nutrition on the elderly; so accurate, reliable measurements of the food security of the elderly are important both for monitoring and research purposes (Sahyoun & Basiotis, 2000; Guthrie & Lin, 2002). In this study, I assess the appropriateness of the U.S. Food Security Scale for measuring the food security of elderly persons and, in particular, whether prevalence rates of food insecurity and hunger are comparable between households with and without elderly persons present.

Statistics based on the September 2000 Food Security Survey Module—the most recent food security data available—indicate that 94 percent of households with an elderly person (i.e., age 65 or over) present were food-secure throughout the year (Nord, 2002). Thus, the remaining 6 percent of households with elderly persons were food-insecure, meaning that at some time during the previous year, these households were either uncertain of having or unable to acquire enough food to meet basic needs of all their members because they had insufficient money or other resources for food.

One in four of the food-insecure elderly households (1.5 percent of all elderly households) were food-insecure to the extent that one or more household members were hungry at least some time during the year because they could not afford enough food. The other three-fourths of food-insecure elderly households obtained enough food to avoid hunger by using a variety of coping strategies such as eating less varied diets, participating in Federal food assistance programs, or getting emergency food from community food pantries. These rates of food insecurity and hunger were about half those of households with no elderly members, and this relationship was observed at all income levels, including households with incomes below the Federal poverty line. The extent of food insecurity and hunger among elderly households remained almost unchanged from that of 1995 (when the first nationally representative food security survey was conducted) through 2000. The corresponding prevalence rates for the nonelderly, on the other hand, declined substantially during this period of economic growth.

There are two areas of greatest concern regarding application of the standard methods for measuring food security to the elderly. The first is whether the questions in the Food Security Scale are understood similarly by the elderly and the nonelderly and whether they experience and respond to food insecurity in similar ways. The standard method depends on self-reported conditions and behaviors related to food access and, as such, may be subject to differences in how people understand and interpret the questions and may be subject to biases in the direction of perceived social desirability. For example, ethnographic findings have suggested that the least severe question in the Food Security Scale, which asks whether respondents worried that their food would run out before they received money to buy more, might be less sensitive for elders. Some elderly persons, at least, report that they just do not worry about such things.

The second area of concern is whether the Food Security Scale is appropriately sensitive to obstacles that particularly affect elders' ability to get adequate, nutritious meals. The Food Security Scale measures, specifically, food insecurity and hunger that are caused by insufficient money or other resources for food. Each question in the scale specifies this resource constraint as a reason for the behavior or condition—for example: "In the last 12 months, did you ever cut the size of your meals or skip meals *because there wasn't enough money for food?*" Factors other than economic resource constraints (e.g., health problems, mobility limitations, and lack of transportation) may be obstacles to elders' ability to obtain adequate nutritious meals, and food-access problems caused by such factors might not be registered by the Food Security Scale (Guthrie & Lin, 2002).

Data and Methods

Data to assess these concerns about measuring the food security of elderly persons were drawn from the August 1998, April 1999, and September 2000 Current Population Survey Food Security Supplements (CPS-FSS). The CPS-FSS is an annual, nationally representative survey of about 42,000 households, which is conducted as a supplement to the monthly CPS labor force survey. In each household, the person most knowledgeable about the food purchased and eaten in the home responds to the questions in the Food Security Supplement. Annual statistics on household food security in the United States are published by the USDA and are based on data from the CPS-FSS.

Separate analysis files were constructed for households in which all persons were age 65 or older (i.e., elderly-only households) and households in which no person was age 65 or older (i.e., nonelderly households). Households with mixed elderly and nonelderly—about 7 percent of all households—were excluded from the analysis.

Scaling Analysis: Do the Elderly and Nonelderly Experience and Respond Similarly to Food Insecurity?

To assess whether the questions in the Food Security Scale are understood similarly by the elderly and the nonelderly and whether they experience and respond similarly to food insecurity, I compared response patterns of elderly-only and nonelderly households. To do so, I used statistical methods based on the Rasch measurement model—the methods originally used to develop the Food Security Scale. This analysis exploits one of the strengths of multiple-indicator measures such as the Food Security Scale: associations among the indicators comprising the scale provide evidence of its validity and reliability.

Furthermore, if the patterns of association among the items in a multiple-indicator measure are similar in two populations, this suggests that the items relate similarly in the two populations to the underlying phenomenon that accounts for their interrelationships; *that is, the items measure the same phenomenon in the two populations*. These methods of scale assessment are more widely used in psychometric research and educational testing than in nutrition and economic research, so I present first a brief summary of the Rasch model and the scale assessment statistics based on it. More detailed information on the Rasch model and associated statistics is available elsewhere.[1]

[1] See Wright (1977; 1983), Wright & Masters (1982), Baker (1992), Hambleton, Swaminathan, & Rogers (1991), and Fischer & Molenaar (1995), and the Website of the MESA psychometric laboratory at the University of Chicago at www.rasch.org. Information about applications of Rasch methods to the development and assessment of food security scales is available in Hamilton et al. (1997a; 1997b), Ohls, Radbill, & Schirm (2001), Bickel et al. (2000), and Nord (2000).

An essential characteristic of the Food Security Scale is that the items comprising it vary across a wide range of severity of food insecurity. The precise severity level of each item (the "item calibration" or "item score") is estimated empirically from the overall pattern of response to the scale items by the interviewed households. However, the range of severity of the conditions identified by the items is also intuitively evident from inspection of the items. For example, not eating for a whole day is a more severe manifestation of food insecurity than is cutting the size of meals or skipping meals. These differences in severity are observed in two ways in the response patterns of surveyed households.

First, more severe items are less frequently affirmed than less severe items. Second, households that affirm a specific item are likely to have also affirmed all items that are less severe, while households that deny the item are likely to also deny all items that are more severe. These typical response patterns are not universal, but they are predominant, and among households that do deviate from the typical patterns, the extent of deviation tends to be slight.

The Rasch model formalizes the concept of severity-ordering of items and provides standard statistical methods to estimate the severity level measured by each item and the severity level experienced by each household. The model also assesses the extent to which the response patterns observed in a data set are consistent with the severity-order concept. The food security of households can be thought of as a continuum, which is represented by a graduated scale, from fully secure to severely insecure with hunger evident. The Rasch model links the severity of items to this same scale as follows: Imagine a household becoming progressively more food-insecure. At very low levels of food insecurity, the household denies all items in the Food Security Scale. As insecurity increases, the household reaches a level where it begins to report, "We worried whether our food would run out before we got money to buy more" (the least severe item in the scale), while continuing to deny the more severe items. That low level of insecurity is the severity score of the "worried" item.

At some more severe level, the household begins to report, "The food we bought didn't last, and we didn't have money to get more," while continuing to affirm the "worried" item but denying all of the more severe items. This higher severity level is the severity score of the item "Food we bought didn't last." Of course, not all households experience or report food security in exactly the same manner, so these relationships are only probablistically true. Technically, half of all households with severity scores equal to that of an item will affirm that item. That is, the average household at this level of severity is right on the edge, equally likely to say "yes" or "no" to the item.

As a household becomes more food-insecure, it is progressively more likely it will affirm each item. The Rasch model is based on a specific mathematical function that relates the probability of a household affirming an item to the difference between the severity-level of the household and the severity score of the item (box 1). Average item discrimination and item-fit statistics, used in this study to compare response patterns of elderly and nonelderly households with questions in the Food Security Scale, are based on the consistency with which households' responses conform to this expected pattern. These statistics are based on the proportions of expected and unexpected responses. Expected responses are denials of an item by households with severity scores below

Box 1. The Rasch Model: Ordering severity level of items and severity level experienced by households

The single-parameter Rasch model, which is used to create the Food Security Scale, assumes that the log of the odds of a household affirming an item is proportional to the difference between the "true" severity level of the household and the "true" severity level of the item. That is, the odds that a household at severity-level h will affirm an item at severity-level i is expressed as: $P_{h,i}/Q_{h,i} = e^{(h-i)}$ where P is the probability that the household will affirm the item, Q is the probability the household will deny the item (that is, 1-p), and e is the base of the natural logarithms.

Item infit is an information-weighted fit statistic that compares the observed responses of all households with the responses expected under the assumptions of the Rasch model. It is calculated as follows:

$$INFIT_1 = SUM\ [(X_{i,h} - P_{i,h})^2] / SUM\ [P_{i,h} - P_{i,h}^2]$$

where:

- $X_{i,h}$ is the observed response of household h to item i (1 if response is yes, 0 if response is no);
- $P_{i,h}$ is the probability of an affirmative response by household h to item i under Rasch assumptions, given the item calibration and the estimated level of severity of food insecurity in the household.

The expected value of each item's infit statistic is 1.0 if the data conform to Rasch model assumptions. Values above 1.0 indicate that the item discriminates less sharply than the average of all items in the scale.

Item outfit is an outlier-sensitive fit statistic that compares the observed responses of all households with the responses expected under the assumptions of the Rasch model. It is calculated as the average across households of the squared error divided by the expected squared error.

$$OUTFIT_i = SUM\ [(X_{i,h} - P_{i,h})^2 / P_{i,h} - P_{i,h}^2] / N$$

where:

- $X_{i,h}$ is the observed response of household h to item i (1 if response is yes, 0 if response is no);
- $P_{i,h}$ is the probability of an affirmative response by household h to item i under Rasch assumptions, given the item calibration and the estimated level of severity of food insecurity in the household;
- N is the number of households.

The expected value of each item's outfit statistic is 1.0 if the data conform to Rasch model assumptions. Values above 1.0 indicate a higher than expected proportion of "erratic" responses—affirmative responses to a severe item by households that affirmed few other items or denials of a low-severity item by households that affirmed many other items.

For further information on these item-fit statistics, see Wright and Masters (1982, pp. 94ff.), Bond and Fox (2001, pp. 176ff.).

that of the item and affirmations of the item by households with severity scores higher than that of the item. Unexpected responses are the opposite. An item with high discrimination has fewer unexpected responses than does an item with low discrimination. Thus, if the same set of items is found to have higher average discrimination in one population than in another, this indicates that the responses were more consistently ordered, and the underlying phenomenon was measured more precisely, in the first population.

The Rasch model assumes that all items discriminate equally and that items discriminate equally for all subpopulations. Comparing average item discrimination between scales fitted separately for the elderly and the nonelderly tests empirically whether the latter assumption is true. Lower item discrimination in a subpopulation would mean either that the behaviors and conditions indicated by the items were less consistently ordered in that subpopulation or that respondents' answers to the questions were less consistently related to the behaviors and conditions in question. The latter condition would occur if the questions were not well understood by the respondents or were not understood to mean the same thing by all respondents.

Item-fit statistics compare the extent of unexpected responses for each specific item to those of the average of all items in the scale. The two most commonly reported item-fit statistics "infit" and "outfit" are used in this study to assess whether the elderly responded less consistently or more erratically than did the nonelderly to specific items in the scale (box 1). For both statistics, a value of 1 indicates that the extent of unexpected responses to the item is at the average for all items in the scale. Values above 1 indicate a disproportionate share of unexpected responses and, therefore, lower discrimination of the item; values below 1 indicate a smaller proportion of unexpected responses and higher discrimination of the item. Infit is "information-weighted" so that it is sensitive to responses by households with severity scores in the range near the severity level of the particular item. Outfit is sensitive to unexpected responses from households with severities much higher or lower than that of the item—that is, to highly improbable or erratic responses (outliers). Outfit is calculated as the sum of squared errors divided by the sum of squared errors expected under model assumptions.

I conducted separate scaling analyses for elderly-only and nonelderly households and compared the results. Households that affirm none of the scale questions, typically nearly 80 percent of all U.S. households and a larger proportion of elderly-only households, and those few households that affirm all questions to which they respond do not provide any information about the *relative* severity of the items in the scale. Households with these "extreme" responses must be excluded from scaling analyses. After these necessary exclusions, the sample of households available for the scaling analysis from the combined CPS-FSS for the 3 years consisted of 2,036 elderly-only households and 17,033 nonelderly households, sufficiently large samples to provide stable, reliable scale statistics.

I recoded responses to the food security questions into dichotomous scale items by following standard editing procedures, as described in the *Guide to Measuring Household Food Security, Revised 2000* (Bickel et al., 2000). Child-referenced items were excluded from both scales in order to maximize comparability, because the elderly-only households were not asked these questions. Data for the two age groups were fitted separately to the Rasch model by using joint-maximum-likelihood methods implemented by ERSRasch (a set of SAS programs developed by ERS for Rasch analysis of food security data).

The elderly-only and nonelderly scales were standardized to the same metric (that of the standard 18-item household scale described in Bickel et al., 2000) so that discrimination parameters and item severities could be meaningfully compared between the two scales. The scales were standardized by applying a linear transformation to each scale's item scores so that means of the item scores could be equated to mean absolute deviation of item scores in the two scales. This particular standardization is justified by the assumption that the scale characteristic most likely to be the same between the two populations is the average severity of the items.

The additive constant in the linear transformation simply provides identification. (Rasch scales are unique only up to an additive transformation, so an identifying constant is supplied arbitrarily in the process of model estimation.) The multiplicative constant in the linear transformation adjusts for any differences in the average item discrimination in the two subpopulations. The Rasch model assumes that item discrimination is the same in all subpopulations. However, we also assume that any given item represents the same level of food insecurity for respondents in both subpopulations. Comparing the discrimination parameters required to obtain the same item dispersion in scales fitted separately to elderly and nonelderly household response data allows one to test whether these two assumptions are compatible.

Alternatively, average item discrimination in the two subpopulations can be

compared by estimating item scores separately for each group with discrimination coefficients set at 1 and then comparing the mean absolute deviations of item scores in the two scales. The two methods are exactly equivalent. The multiplier required to equate mean absolute deviation is the inverse of the discrimination coefficient that would have to be specified to achieve the same mean absolute deviation of item scores. Adjusting the item scores has the advantage of facilitating comparison of relative item severities between the two subpopulations.

I compared average item discrimination, item-fit statistics, and relative item severity scores of the elderly-only scale with those of the nonelderly scale. Average item discrimination and item-fit statistics provide information about the consistency of ordering of responses to the questions in the scale. If elderly-only responses were less consistently ordered or more erratic, then the average item discrimination for their scale would be lower, and item-fit statistics of affected items would be higher, than the corresponding statistics for the nonelderly scale.

If the two age groups understood a question differently, or if the behavior or condition in question related differently to food insecurity for the two groups, then the severity score of that item relative to those of other items would differ between the scales for the two groups. On the other hand, similar relative severity scores across all items for the two age groups would suggest that the items are understood similarly by the two groups and that the two groups experience and respond to food insecurity similarly.

Other Indications of Food Problems Faced by the Elderly

CPS-FSS asked respondents several questions additional to those that constitute the Food Security Scale. These other questions identified various food problems that may have been encountered. One of these questions, the so-called *food sufficiency* question, has been used for many years in food consumption and health surveys. It asks: "Which of these statements best describes the food eaten in your household—(1) enough of the kinds of food we want to eat, (2) enough but not always the *kinds* of food we want to eat, (3) sometimes not enough to eat, or (4) often not enough to eat?" This question does not explicitly specify a resource constraint as the cause of the food condition and may, therefore, be sensitive to food-access problems that are not caused directly by insufficient money to buy food.

I compared the proportions of elderly-only and nonelderly households reporting in each category of this question to assess whether food problems other than insufficient resources to buy food were more prevalent for elderly than nonelderly households. I also cross-classified households in each age group by their food sufficiency status and food security status to assess whether the Food Security Scale was less sensitive to food problems revealed by the food sufficiency question for elderly than for nonelderly households.

Households responding "We had enough but not always the *kinds* of food we want to eat" were then asked the following: "Here are some reasons why people don't always have the kinds of food they want. For each one, please tell me if that is a reason why YOU don't always have the kinds of food you want to eat." Reasons presented for a yes or no response were

- Not enough money for food
- Kinds of food we want not available
- Not enough time for shopping or cooking
- Too hard to get to the store
- On a special diet

Households responding that they sometimes or often did not have enough to eat were asked a similar follow-up. "Here are some reasons why people don't always have enough to eat. For each one, please tell me if that is a reason why YOU might not always have enough to eat." Reasons presented for a yes or no response were

- Not enough money for food
- Not enough time for shopping or cooking
- Too hard to get to the store
- On a diet
- No working stove available
- Not able to cook or eat because of health problems

I compared the proportions of the elderly-only and nonelderly households reporting selected problems to examine whether food problems other than insufficient resources to buy food affected the elderly more so than they did the nonelderly. The food security status of households reporting each food access problem was also examined to assess whether the Food Security Scale is less sensitive to other food access problems for the elderly than for the nonelderly.

Only data from the 1999 and 2000 CPS-FSS were used for the analysis of the food sufficiency question and its follow-ups because a somewhat different set of follow-up questions was asked in 1998. Mixed-age households (elderly and nonelderly living together) were excluded from the analysis as were those who did not respond to the

food sufficiency question (3.9 percent). Unlike the scaling analysis, however, this analysis included households that denied or affirmed all scale items, so the sample sizes were large in spite of restricting the analysis to 2 years of data: 13,078 elderly-only households and 59,203 nonelderly households.

Other Indicators of Unmet Food Needs Among Food-Secure Elderly and Nonelderly Households

Some households turn to Federal or community food assistance programs when they have insufficient money and other resources for food. Households that use these programs and are classified as food-secure may either have underreported the extent to which they are food insecure or may have depended on these programs to get enough food to be food-secure. To assess the extent of these conditions, I compared the proportions of food-secure elderly-only and nonelderly households that used four food assistance programs that are available to elderly-only households and are reported in the CPS-FSS: the Food Stamp Program, senior meals (either Meals on Wheels or meals at a senior center), getting emergency food from a food pantry, and eating meals at an emergency soup kitchen.

CPS-FSS data from the 1998, 1999, and 2000 surveys were combined for this analysis. Most households with annual incomes above about 185 percent of the Federal poverty line were not asked questions about their use of food programs, so the analysis was restricted to households with incomes below this level. The 3-year CPS-FSS sample of low-income food-secure households consisted of 7,072 elderly-only households and 14,524 nonelderly households. For the analysis of food stamp participation, the analysis was further restricted to households with annual incomes below 130 percent of the Federal poverty line to exclude most households that were not income-eligible for food stamps. This sample consisted of 3,467 elderly-only households and 9,152 nonelderly households.

Results

Scaling Analysis

The response patterns of elderly-only households reflected greater consistency with the severity order of the items than did those of nonelderly households. With the dispersion of item scores equated, the discrimination parameter was 1.25 for elderly-only households versus 1.02 for nonelderly households (table 1). This indicates somewhat greater consistency in the way in which the elderly experience and manage food insecurity and may also indicate more consistent understanding of the questions by elderly respondents.

Item-fit statistics confirm that the greater consistency of elderly-only responses was generally true for all items in the scale. There are no hard-and-fast rules for assessing item-fit statistics, but infits in the range of 0.8 to 1.2 are generally considered to be quite good, and 0.7 to 1.3 may be acceptable (Hamilton et al., 1997b; Linacre & Wright, 1994). Infit statistics for both samples were within an acceptable range and were remarkably similar between the two age groups for corresponding items.[2] The outfit statistic for "Worried food would run out" was somewhat high (indicating erratic responses) in both samples but less so in the elderly sample. The most

Results of the scaling analysis allay concerns that the standard scale underreports the prevalence of food insecurity and hunger among the elderly because of differences in how they interpret and respond to the questions in the Food Security Survey Module.

[2] The lower-than-expected infits for the two pairs of mutually dependent items (the frequency-of-occurrence follow-up items and their base items) in both scales are artifacts of the statistical dependence of these items.

Table 1. Item severity scores and fit statistics for elderly-only and nonelderly Food Security Scales

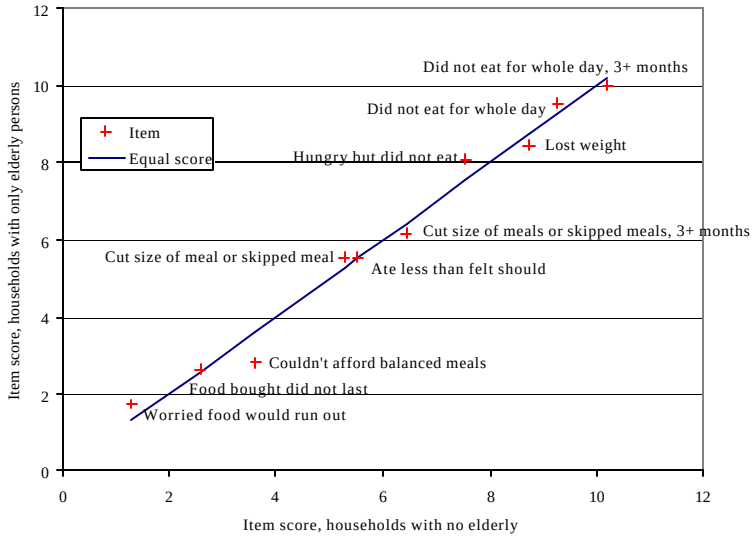
Item	Elderly-only households (n=2,036)			Nonelderly households (n=17,033)		
	Severity score[1]	Infit[2]	Outfit[3]	Severity score[1]	Infit[2]	Outfit[3]
Worried food would run out	1.74	1.05	4.30	1.29	1.10	8.41
Food bought didn't last	2.64	.85	1.80	2.57	.98	3.83
Couldn't afford balanced meals	2.83	1.22	12.70	3.61	1.23	4.07
Cut size of meal or skipped meal	5.54	.77	.60	5.29	.71	.55
Ate less than felt should	5.53	.96	.71	5.52	.87	.77
Cut size of meal or skipped meal, 3+ months	6.16	.76	.39	6.43	.77	.48
Hungry but didn't eat	8.06	.86	.32	7.56	.95	.70
Lost weight	8.45	1.11	1.26	8.74	1.04	.60
Didn't eat for whole day	9.53	.95	.42	9.28	.87	.53
Didn't eat for whole day, 3+ months	10.01	.83	.19	10.21	.79	.23
Mean	6.04			6.05		
Mean absolute deviation	2.39			2.39		
Standard deviation	2.81			2.81		
Discrimination coefficient[4]	1.25			1.02		

[1]The severity score of an item reflects the level of severity of food insecurity in households that are equally likely to report or to deny that the condition existed during the year. The metric of the severity scores is logistic (log-odds), and the zero point is arbitrary.
[2]Infit is a measure of the extent to which responses of all households to an item deviate from expectations based on the statistical measurement model used to create the scale (the Rasch model). Infits higher than 1 indicate a higher proportion of inconsistent responses (i.e., lower discrimination) than the other items in the scale. Infits lower than 1 indicate a lower proportion of inconsistent responses (higher discrimination) than the other items in the scale.
[3]Outfit is similar to infit except that it is more sensitive to highly erratic responses (outliers). Values higher than 1 indicate a higher-than-expected proportion of erratic responses (e.g., denial of a low-severity item by a household that affirms many higher-severity items). Values lower than 1 indicate fewer such responses than would be expected under model assumptions.
[4]Discrimination parameters were adjusted to equate the mean absolute deviation of item scores for each scale to that of the corresponding items in the standard scale as described in *Guide to Measuring Household Food Security, Revised 2000* (Bickel et al., 2000). A constant was then added to each scale to equate the mean of the item scores to that of the corresponding items in the standard scale.

notable outfit statistic was the high value (12.7) for "Couldn't afford balanced meals" in the elderly subsample. This indicates that elderly-only responses to this item were more erratic than their responses to other items and more erratic than responses of the nonelderly to this item. Because "Couldn't afford balanced meals" is a low-severity item (2.83), these erratic or improbable responses would have been denials of this item by households that affirmed many other items. It is not known whether these reflect genuine differences in how food insecurity is experienced by different elderly households, misunderstanding of the item by some elderly respondents, or coding errors by interviewers. Outfits this high can result from highly unexpected responses by just a few discrepant cases (three or four cases in a sample of this size), so further research is warranted prior to drawing conclusions about the suitability of the item for assessing food security of the elderly.

Relative item severities were generally consistent between the elderly-only and nonelderly scales (fig. 1). This is evidence that the scale measures the same underlying phenomenon in both populations: that the questions are understood similarly by elderly and nonelderly persons and that the two groups experience and respond to food insecurity similarly. An underlying assumption of the Rasch model is that the inter-relationships among the indicator items result from the relationships of each individual item to the underlying phenomenon (in this case, food insecurity). Thus, similar patterns of relationships among the indicator items in two populations are evidence that the items relate similarly to the underlying phenomenon in the two populations. If elderly people underreport food insecurity and hunger, then they do so with remarkable consistency across almost all of the items. The item about worrying is somewhat more severe (less often reported at similar levels of severity) on the elderly-only scale, as suggested by ethnographic research findings, but the difference is only about 0.45 logistic units, corresponding to an odds ratio of 0.64 (calculated by exponentiating the difference in item scores; 90 percent confidence interval is 0.58 to 0.70).

Figure 1. Comparison of item severity scores,[1] elderly-only households versus nonelderly households



[1]The severity score of an item reflects the level of severity of food insecurity in households that are equally likely to report or to deny that the condition existed during the year. Note: An item falling on the "equal score" line would represent the same level of food insecurity in households with only elderly persons as in households with no elderly person present.

The most notable difference in item scores of elderly-only households, compared with the nonelderly, is the lower item severity (more frequently reported at similar levels of severity) on the elderly-only scale of the item "We couldn't afford to eat balanced meals." This item was 0.78 logistic units less severe for the elderly, corresponding to an odds ratio of 2.2 (90 percent confidence interval 2.01 to 2.39). That is, elderly-only households were more than twice as likely to report this condition as were nonelderly households at the same overall level of food insecurity. It is possible that this occurs because the elderly's perceived standard of what a balanced meal consists of is more stringent than is true of the nonelderly. Thus it is harder to achieve, and they are more likely to report being unable to afford a balanced meal.

The item about balanced meals is the threshold item for classifying households as food-insecure. That is, it is the third item in severity order, and households must affirm at least three items to be classified as food-insecure.[3] Therefore, its lower severity in the elderly scale would result in a slight *upward* bias on the prevalence of food insecurity among the elderly, compared with the nonelderly, as measured by the standard methods. This bias occurs because each group of households with the same raw score actually includes households with a range of "true" food security severity levels. If all of the items except the balanced meals item have the same item scores in elderly and nonelderly households, and if the

[3] Under Rasch assumptions, a raw score for the number of affirmative responses is an ordinal measure of the underlying construct (food insecurity in this case), provided households respond to the same set of questions. Thus, classification of households as to their food security status is based on their raw scores. Households that affirm 3 or more of the 10 items in the scale assessed in this article are classified as food insecure irrespective of which 3 items they affirm. Households that affirm 6 or more of the items are classified as food insecure with hunger.

balanced meals item has a lower severity score for the elderly than for the nonelderly, then some elderly households with "true" food security just below the food insecurity threshold will, nevertheless, affirm the balanced meals item and therefore be misclassified as food insecure by the standard food security classification procedures.

The severity scores of items near the hunger threshold (cut size of meals or skipped meals in 3 or more months) were almost the same for the elderly-only and nonelderly scales. Therefore, estimates of the prevalence of hunger among the elderly are not likely to be biased and can be meaningfully compared with those of the general population.

Other Indications of Food Problems Faced by the Elderly

Elderly-only households were about half as likely as nonelderly households to register food problems in response to the food sufficiency question, a ratio consistent with their relative rates of food insecurity and hunger based on the Food Security Scale. About 10 percent of elderly-only households indicated any problem (they did not always have enough to eat or they did not always have the kinds of food they wanted to eat), compared with nearly 20 percent of the nonelderly (table 2). Among elderly-only households, 1.7 percent reported that they sometimes or often did not have enough to eat, compared with 4.2 percent of nonelderly households. On both measures, the elderly/nonelderly differences could reflect a general stoicism of the elderly with regard to food needs, but the similar pattern across the two measures suggests, at least, that food-access problems *other than insufficient resources to buy food* do not affect the elderly in substantially larger proportions, compared with the effect on the nonelderly.

Table 2. Food sufficiency status versus food security status of elderly-only and nonelderly households, average 1999-2000

Food sufficiency status	Elderly-only households (n=13,078)	Nonelderly households (n=59,203)
	Percent	
Enough of the kinds of food we want to eat	89.89	80.46
Food-secure	88.76	78.09
Food-insecure without hunger	1.03	2.06
Food-insecure with hunger	.10	.30
Enough to eat but not always the kinds of food we want	8.44	15.30
Food-secure	6.09	9.65
Food-insecure without hunger	1.81	4.43
Food-insecure with hunger	.54	1.22
Sometimes not enough to eat	1.39	3.49
Food-secure	.23	.58
Food-insecure without hunger	.57	1.46
Food-insecure with hunger	.58	1.45
Often not enough to eat	.29	.75
Food-secure	.05	.07
Food-insecure without hunger	.04	.13
Food-insecure with hunger	.20	.54

Note: All percentages were calculated using sample weights provided by the Census Bureau so that the interviewed households represent the U.S. noninstitutionalized population.

Specific food problems other than insufficient resources to buy food were no more prevalent among elderly-only households than among nonelderly households (table 3). Not surprisingly, lack of time for shopping or cooking was much less of a problem for the elderly-only than for the nonelderly households. The prevalences of other problems were remarkably similar for the elderly and nonelderly households. This was true even of problems such as "too hard to get to the store" and "not able to cook or eat because of health problems," which might be thought of as being more problematic for the elderly. These problems account for a greater proportion of those elderly-only house-holds that reported *any* problem than was true for nonelderly households. For example, 1.68 percent of elderly-only households reported that they sometimes or often did not have enough to eat (table 2). Included among these households were 0.66 percent who said this was because it was too hard to get to the store. Thus, this problem accounted for 39 percent of elderly-only households who sometimes or often did not have enough to eat. The corresponding statistic for nonelderly households was 19 percent.

Other Indicators of Unmet Food Needs Among Food-Secure Elderly and Nonelderly Households

Food-secure elderly-only households relied less on Federal and community food assistance programs than did nonelderly households, with the exception of meal programs that are specifically intended for senior citizens (table 4). Among food-secure households with annual incomes below 130

Table 3. Other food problems reported by elderly-only and nonelderly households, average 1999-2000

Food problem	Elderly-only households (n=13,078)	Nonelderly households (n=59,203)
	Percent	
Enough to eat but not always the kinds of food we want because:		
Not enough time for shopping or cooking	0.95	5.93
Food-secure	.79	4.34
Food-insecure (with or without hunger)	.16	1.59
Too hard to get to the store	2.48	2.62
Food-secure	1.56	1.62
Food-insecure (with or without hunger)	.92	1.00
On a special diet	2.12	1.90
Food-secure	1.61	1.35
Food-insecure (with or without hunger)	.51	.55
Sometimes or often not enough to eat because:		
Not enough time for shopping or cooking	.18	.72
Food-secure	.06	.22
Food-insecure without hunger	.08	.26
Food-insecure with hunger	.05	.25
Too hard to get to the store	.66	.79
Food-secure	.13	.10
Food-insecure without hunger	.24	.28
Food-insecure with hunger	.29	.41
On a diet	.23	.34
Food-secure	.03	.10
Food-insecure without hunger	.08	.11
Food-insecure with hunger	.12	.12
No working stove available	.01	.15
Food-secure	0.00	.02
Food-insecure without hunger	.01	.04
Food-insecure with hunger	0.00	.09
Not able to cook or eat because of health problems	.23	.29
Food-secure	.06	.02
Food-insecure without hunger	.09	.09
Food-insecure with hunger	.09	.18

Note: All percentages were calculated by using sample weights provided by the Census Bureau so that the interviewed households represent the U.S. noninstitutionalized population.

percent of the Federal poverty line, about 12 percent of elderly-only households reported receiving food stamps during the previous 12 months, compared with about 22 percent of nonelderly households. Food-secure elderly-only households with income below 185 percent of the Federal poverty line also were less likely to receive food from a church, food pantry, or food bank than were their counterparts: food-secure nonelderly households. Use of emergency (soup) kitchens by food-secure households in both age groups was rare and did not differ substantially. These findings suggest that elderly households with unmet food needs, or who are meeting some of their food needs from food assistance programs, are no more likely to be classified as food-secure than are nonelderly households.

About 8 percent of food-secure elderly-only households with annual incomes below 185 percent of the Federal poverty line received assistance from community meal programs. This assistance included either prepared meals eaten at community programs or senior centers or meals delivered to their homes by programs such as "Meals on Wheels." About 14 percent of low-income food-secure elderly-only households received assistance from one or more of the four food assistance programs analyzed. This suggests that some elderly households with unmet food needs, or who were meeting part of their food needs from food assistance programs, were classified as food secure. The food security of these households may have been tenuous or marginal at times, or they may, indeed, have been food-insecure. Similar, or even higher, reliance on these programs by nonelderly households, however, suggests that any questionable classification or misclassification is no more prevalent for the elderly than for the nonelderly.

Table 4. Use of Federal and community food assistance programs by low-income, food-secure, elderly-only and nonelderly households, average 1998-2000

Food assistance	Elderly-only households	Nonelderly households
	Percent	
Food-secure households with annual income below 130 percent of the Federal poverty line		
Received food stamps	12.4	21.7
Food-secure households with annual income below 185 percent of the Federal poverty line		
Senior meals (delivered to home or in center)	7.7	NA
Received emergency food from church, food pantry, or food bank	2.2	3.2
Ate a meal at a soup kitchen	.3	.4
Received assistance from any of these four programs	14.4	17.2
Number of cases, income below 130 percent of Federal poverty line (unweighted)	3,467	9,152
Number of cases, income below 185 percent of Federal poverty line (unweighted)	7,072	14,524

Note: All percentages were calculated by using sample weights provided by the Census Bureau so that the interviewed households represent the U.S. noninstitutionalized population.

Conclusions

The U.S. Food Security Scale fairly represents the food security of the elderly, compared with that of the nonelderly. Results of the scaling analysis allay concerns that the standard scale underreports the prevalence of food insecurity and hunger among the elderly because of differences in how they interpret and respond to the questions in the Food Security Survey Module. With one exception, relative item severities were similar for elderly-only and nonelderly households, and the exception would lead to a slight *upward* bias on measured food insecurity (but not hunger) among the elderly. Overall, response patterns of the elderly, compared with the nonelderly, were more consistent with the severity-order of the items, and this was true of all items except, possibly, the item about balanced meals, to which the elderly responded somewhat more erratically than did the nonelderly. It cannot be ruled out that elders underreport all indicators of food insecurity and hunger, but this underreporting would have to be remarkably consistent across almost all items to result in the similarity of relative item severities observed in this study.

Responses to the food sufficiency question indicate that the elderly do face food-access problems other than insufficient resources to buy food—most notably problems getting to a store. However, these problems are no more likely for elderly than nonelderly households to be so serious as to disrupt desired eating patterns or result in having insufficient food to eat.

A small proportion of elderly households classified as food-secure obtain food assistance from Federal and community programs. Some of these households probably are less than fully food-secure, and some may, indeed, be food-insecure. However, food-secure elderly-only households are less likely than are food-secure nonelderly households to rely on programs that are accessible to both.

Clearly, the Food Security Scale is not a perfect or complete measure of food security. It measures primarily the main dimension of food security—assured access to sufficient and adequate food. It does not measure food safety and only indirectly measures the dimension of social acceptability of methods used to acquire enough food. Furthermore, not all food problems faced by the elderly (or by the nonelderly) are usefully considered as food security problems. Nutrition security, a somewhat broader concept that includes food security as well as other factors affecting the nutrition of those who are food secure, may be a useful framework for assessing and interrelating the range of issues that affect nutritional adequacy of the diets of the elderly, as well as the nonelderly (Garrett & Ruel, 2000).

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